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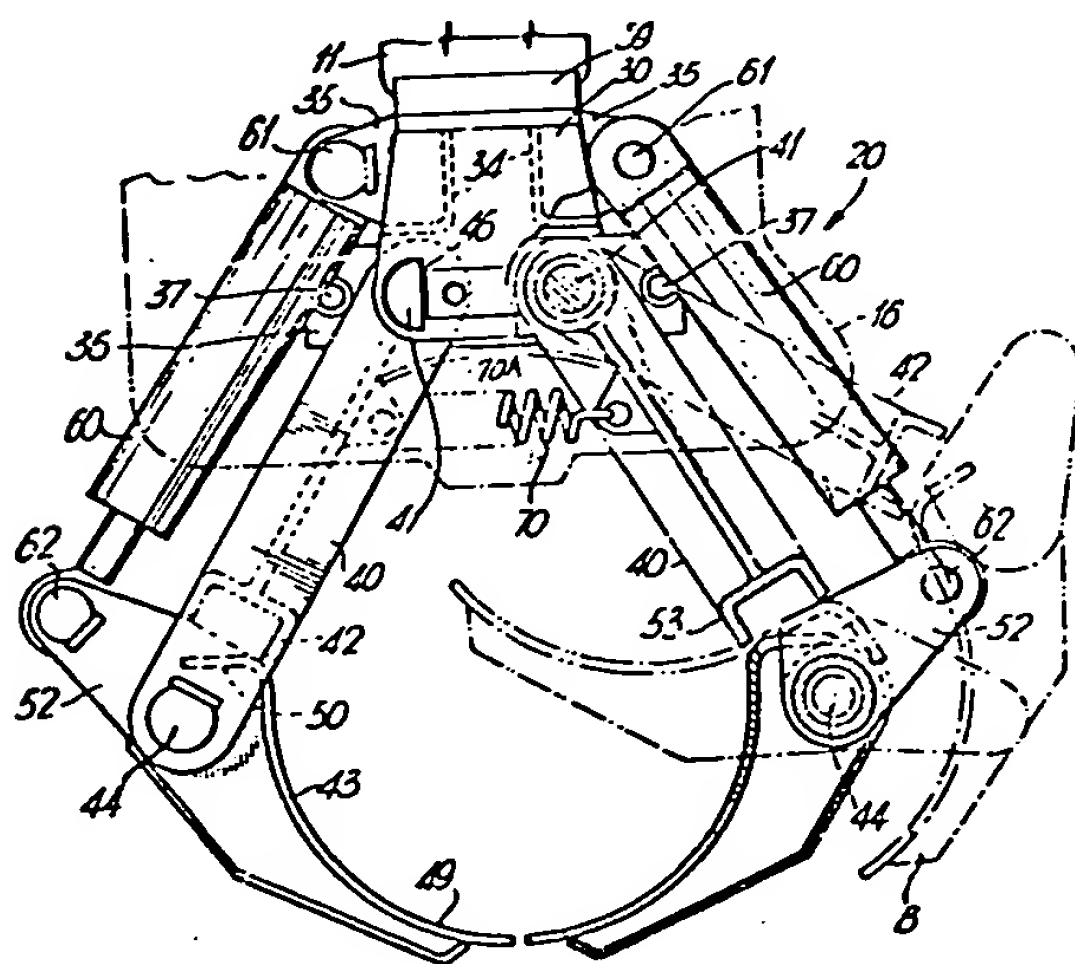
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Grapple accumulator for tree trunks - includes articulated arm pivot mounted adjacent one end of grapple arms frame

LOGGING DEV CORP 27.04.76-CA-251116

Q38 (08.08.78) A01g-23 B66f-09/18

Articulated arm is pivotally mounted adjacent one end to a frame having grapple arms, the arm comprising a rigid lever and a rigid finger. There are means associated with



the lever resisting pivotal movement relative to the frame. Interengageable stops respectively on the finger and lever limit pivotal movement of the finger in each of opposite directions about its pivotal connection to the lever. A power actuator is attached to the finger and attached to the frame for pivotally moving the lever arm relative to the frame

and the finger relative to the lever arm.

The frame has one arm mounted on it and a second arm pivotally attached to the frame for swinging toward and away from the first. The arms define a jaw for a tree or group of trees, and the second arm comprises a lever arm pivotally attached adjacent one end of the frame. A finger is pivotally attached adjacent an opposite end. An interengageable stop on the lever arm and finger limit pivotal movement of the latter relative to the lever arm. A power actuator connected to the frame and finger effect swinging movement. 27.4.76 as 251116 (15pp926)

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(19) (CA) **CANADIAN PATENT** (12)

(54) APPARATUS FOR ACCUMULATING TREES DURING
HARVESTING OF THE SAME

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Granted to Logging Development Corporation,
Canada

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No. OF CLAIMS 16

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This invention relates to a device for use in conjunction with a grapple for accumulating slender articles, such as trees, poles or the like, as they are collected and to a tree felling head incorporating such device.

Although the specific purpose of the present invention is concerned with apparatus for accumulating trees as they are harvested, it will be appreciated, from the detailed description to follow, the apparatus per se may be utilized to provide a grapple of novel construction and operation.

10 Tree felling heads having apparatus thereon for accumulating trees as they are harvested are known in the art and reference may be had to Coffey's Canadian Patent 911,860 issued October 10, 1972; Smith's Canadian Patent 961,383 issued January 21, 1975; Kurelek's U. S. Patent 3,875,983 issued April 8, 1975; Iarocci's et al U. S. Patent 3,866,985 issued June 3, 1975; Tucek's U. S. Patent 3,910,326 issued October 7, 1975 and U. S. Patent 3,911,981 issued October 14, 1975; and Coughran's Canadian Patent 987,449.

20 From the foregoing references it will be seen the accumulator type grapple may be an assembly complete in itself or a separate assembly used in conjunction with a regular grapple for retaining trees in the grapple while it is opened to receive further trees. In the latter instance, an articulated arm is provided with power means for snatching it out from between the collected trees.

A principal object of the present invention is to provide an improved device for use in accumulating slender articles simplifying construction and operation thereof.

30 Accordingly, there is provided in accordance with one aspect of the present invention an articulated arm adapted to be pivotally mounted adjacent one end thereof to a frame having grapple arms thereon to provide an accumulator type grapple, said articulated arm comprising a rigid lever member and a rigid finger member pivotally attached thereto and freely movable, means associated with said lever resisting pivotal

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movement thereof relative to said frame, interengageable stop means respectively on the finger and lever member limiting pivotal movement of the finger in each of opposite directions about its pivotal connection to the lever member, and a power actuator attached to the finger member and adapted to be attached to the frame for pivotally moving the lever arm relative to the frame and the finger relative to the lever arm.

In accordance with a further aspect of the present invention there is provided a grapple for use in collecting and handling trees comprising a frame having a first arm mounted thereon and a second arm 10 pivotally attached to the frame for swinging toward and away from the first arm, said arms defining a jaw for receiving and embracing a tree or group of trees, said second arm comprising a lever arm pivotally attached adjacent one end thereof to the frame and having a finger member pivotally attached thereto adjacent an opposite end thereof, means associated with said lever arm resisting movement of the same in at least one of the directions of movement thereof toward and away from said first arm, interengageable stop means on said lever arm and finger member limiting pivotal movement of the latter relative to the lever arm in each of opposite directions, and power actuator means 20 connected to said frame and finger member to effect swinging movement of each of said lever arm and finger member about their respective pivots.

The invention is illustrated by way of example with reference to the accompanying drawings wherein:

Figure 1 is a side elevational view of a felling head incorporating a device constructed in accordance with the present invention;

Figure 2 is a partial sectional top plan view illustrating details of the device constructed in accordance with the present 30 invention;

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Figure 3 is a front elevational view of Figure 2; and

Figure 4 is a partial sectional right-hand elevational view of Figure 2.

Referring now in detail to the drawings, there is illustrated, in Figure 1, one preferred embodiment of the invention consisting of a tree felling head 10 having a device 20, provided in accordance with another aspect of the present invention, attached thereto. The felling head per se is described in detail in applicant's Canadian Patent 980,663 issued December 30, 1975 and consists generally of a rigid frame 11 having a grapple 12 and a tree severing device 13 attached thereto. The frame 11 is provided with abutments 14 and 15 at opposite ends thereof to stabilize trees grasped by the grapple 12. The grapple consists of a pair of arms 12A and 12B pivotally mounted on the frame by respective ones of a pair of pivot pins 12C and controllably moved by a hydraulic piston cylinder power actuator assembly 12D. The tree severing device 13 has shear blades mounted on the free end of respective ones of a pair of arms 13A pivotally attached to the frame by respective ones of a pair of pivot pins 13B, the arms being controllably moved by a hydraulic piston cylinder power actuator 13C. The operation of tree felling heads is well known and it is deemed unnecessary to discuss the same herein.

Referring now to Figures 2 to 4 inclusive, the device 20 consists of a rigid frame member 30 having a pair of articulated arms 40 pivotally attached thereto by respective ones of a pair of pivot pins 41 and swingably controlled by respective ones of a pair of hydraulic actuators 60.

The frame 30 is a weldment consisting generally of a pair of flanges 31 and 32 interconnected by a web 33 and reinforced by gussets 34. Lugs 35 are secured to the web 33 and gusset plate 34 and have

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aligned apertures for receiving pivot pins 61 connecting one end of the hydraulic cylinder units 60 to the frame. A bar member 36 is attached to flange 31 and extends laterally therebeyond for receiving bolts 37 to anchor the device 20 to a flange 16 attached to the frame 11 of the felling head and, as seen from Figure 1, such flange constitutes part of the mounting bracket for the arms of the grapple and tree severing device. The frame 30 of device 20 is further attached to the felling head frame 11 by studs 38 threaded into a spacer block 39 attached to the frame 11 of the felling head by means of welding or the like.

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Each articulated arm 40 consists of a primary member or lever arm 42 and a secondary member or finger 43 pivotally interconnected by a pivot pin 44. Pivot pin 44 is disposed adjacent one end of the lever arm 42 and the opposite end of the lever arm is pivotally connected to the frame 30 by the pivot pins 41, pivot pins 41 being securely retained in flange 32 and bar 36 of the frame 30. The lever arms are I-beams and have a sleeve 45 rigidly attached thereto and which are journaled on respective ones of the pair of pivot pins 41. The pins 41 have a segmental portion of the head removed providing a flattened face 46 which bears against a bar member 47 attached to flange 32 preventing rotation of the pins. The pair of lever arms 42 are interconnected by a tension coil spring 70 resiliently urging the free end of the lever arms in a direction toward one another.

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Each finger member 43 is a rigid weldment having a curved face plate 49 for engagement with the trees accumulated in the jaw defined by the pair of articulated arms 40. The curved face plate 49 has a portion 50 turned inwardly partially around a sleeve 51 secured to the finger and journaled on the pivot pin 44. A pair of lugs 52 are rigidly secured to the sleeve 51 and have aligned apertures receiving pivot pins 62 attaching the piston rod portion of power actuator 60

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to the finger. Each of the lever arms 42 has a channel member 53 rigidly secured thereto and extending transverse to the length thereof. The channel 53 engages the face plate 49 of the finger providing a stop limiting pivotal movement of the finger relative to the lever arm in one direction, such limit position being illustrated in phantom in Figure 2 and designated A. Swinging movement of the finger in the opposite direction about pivot pin 44 is limited by engagement of the lugs 52 with the channel member 53. The swinging movement of the finger on the lever arm is thus limited in its travel permitting the use of a single hydraulic actuator to control movement of the articulated arm associated therewith as well as movement of the finger relative to the lever arm.

A tension spring 70 anchored respectively at opposite ends to respective ones of the pair of lever arms 42 urges the free outer ends thereof in a direction toward one another. The tension of the spring is correlated with the relative positioning of pivot pins 61, 62, 41 and 44 such that when the finger is in the position illustrated in phantom and designated A, retraction of the power actuator cylinder causes the finger to pivot to the position illustrated in solid line before lever arm 42 pivots relative to the frame 30 about pivot pin 41. At the position illustrated in solid line, lug 52 is in engagement with stop member 53 on the lever arm 42 and further retraction of the power actuator 60 then causes the lever arm 42 to pivot about pivot pin 41 moving the articulated arm to a position illustrated partly in phantom and designated B. By this arrangement, only one hydraulic cylinder assembly 60 is required for each articulated arm and still permits snaking out the finger from between trees during the accumulation of trees.

From Figure 1 it will be readily apparent the device 20 is arranged relative to the grapple 12 such that they each embrace the same tree or group of trees. When a tree is harvested it is grasped by grapple 12 and after being severed from its roots by the shear 13 is

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forcibly moved into an accumulating position by the fingers 43. On harvesting a further tree, it is grasped by the arms of grapple 12 and the articulated arms 40 of device 20 are then snaked out from between the trees by actuation of power actuators 60 and then manipulated to embrace the further harvested tree which, after being severed from its roots, is again pressed against the previously collected trees by the finger members 43.

Although the device 20 illustrated in the drawings has a pair of articulated arms 40 which operate in conjunction with grapple 12 for accumulating trees as they are harvested, it is possible to use only one articulated arm 40 to accomplish the same purpose, i.e. retain trees in the jaw of the grapple 12 while it is opened to receive further trees. Also it will be apparent that in the device illustrated in Figure 2 one of the pair of articulated arms 40 may be replaced by a single rigid arm or finger secured to and projecting from the frame 30 serving as an abutment for the trees. In such instance the one articulated arm would be swingably mounted for movement in a direction toward and away from the rigid arm.

It will also be apparent the device 20 illustrated in Figures 2, 3 and 4 may be used solely as a grapple for handling poles, logs, trees or the like and not in conjunction with a felling head or another grapple as disclosed hereinbefore in applicant's preferred embodiment directed to accumulating trees as they are harvested.

In a further modification to the apparatus, coil spring 70 illustrated in Figure 2 interconnecting arms 42 may be replaced, if desired, by a single curved leaf spring, i.e. leaf spring shown in phantom and designated 70A in Figure 2 attached at opposite ends to the web of the I-beam type arms 42. This may be preferred in some instances where operation of the coil spring may be hindered by pieces of branches getting stuck between adjacent helices of the coil. The coil spring may also be replaced by an elastic member and furthermore any of the spring means may be anchored at one end to the frame and

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at the other end to lever arm 42, in which case a spring member would be required for each of the pair of arms. Also, if desired, resilient bias of the arms 42 may be provided by a coil spring arranged around or in sleeve 45 and anchored at one end to the sleeve and, at the other end, to frame 30.

10 In a still further modification coil spring 70 may be dispensed with and instead of having the free end of lever arms 42 biased in a direction toward one another, means may be provided restraining pivotal movement of the respective arms relative to the frame 30. One such means is illustrated in Figures 3 and 4 and consists of one or more Belleville washers 80 on the respective pivot pins 41 held in a state of compression between flanges 31 and/or flange 32 and the adjacent outer face of the arm 42. A Belleville washer is a cone-type washer well known in the art and need not be described in further detail. Alternatively, means resisting pivotal movement of the arms 42 on the frame 30 may be provided by a frictional fit of pin 41 in the sleeve 45 of the arm in which case, if desired, sleeves 45 may also be provided with a rubber bushing illustrated in phantom in Figure 4 and identified by reference numeral 90. If desired, the means 20 80 and/or 90 resisting pivotal movement of the arm may be used in combination with the previously described spring means resiliently biasing the free end of the arms 42 in a direction toward one another. The purpose of the means resisting movement of the arms is to cause finger members 43 to be moved on their respective pivots 44 by actuators 60 before effecting pivotal movement of the arms 42 on their pivots 41. Movement of the arms 42 by actuator 60 is thus by way of a lost motion action, the amount of which lost motion is determined by engagement of the face plate 49 and lugs 52 with abutment 53. Engagement of the face plate 49 and lug 52 with the member 53 defines opposite limits for 30 movement of the finger relative to respective ones of the lever arms 42.

Also, if desired, pivotal movement of arms 42 on their respective pivots 41 may be restricted to a limited arc by stop members (not shown)

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for example arranged on frame 30 and/or plate 16 and engageable with respective ones of the arms. Such stops may limit the arcuate movement of the respective arms in each of opposite directions of pivotal movement of such arms.

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The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A device for use in accumulating slender articles, such as trees, logs or the like, in a grapple comprising an articulated arm adapted to be pivotally mounted adjacent one end thereof to a frame having grapple arms thereon, said articulated arm comprising a rigid lever member and a rigid finger member pivotally attached thereto, means associated with said lever member restraining pivotal movement thereof relative to the frame in at least one direction of pivotal movement thereof, interengageable stop means respectively on the finger and lever member limiting pivotal movement of the finger in each of opposite directions about its pivotal connection to the lever member, and a power actuator attached to the finger member and adapted to be attached to the frame for pivoting the finger relative to the lever member and the latter relative to the frame through a lost motion action limited by said stop means.

2. A device as defined in claim 1 including a second arm disposed to coact with the articulated arm to provide a grapple jaw.

3. A device as defined in claim 2 wherein said second arm is a swingably mounted articulated arm comprising a lever member, finger member and power actuator as defined in claim 1.

4. A device as defined in claim 1 wherein said means restraining movement of said lever member comprises a spring.

5. A device as defined in claim 4 wherein said spring and power actuator are interrelated such that pivotal movement of the finger relative to the lever member in a direction tending to bring such members into alignment end-to-end is effected before pivotal movement of the lever arm relative to the frame commences in a direction against the tension of the spring.

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6. A grapple for use in collecting and handling slender articles, such as poles, trees or the like, comprising a frame having a first arm mounted thereon and a second arm pivotally attached to the frame for swinging toward and away from said first arm, said arms defining a jaw for receiving and embracing a tree or group of trees, said second arm comprising a lever arm pivotally attached adjacent one end thereof to the frame and having a finger member pivotally attached thereto adjacent an opposite end thereof, means operatively associated with said lever arm resisting pivotal movement thereof in at least of its directions of movement toward and away from said first arm, interengageable stop means on said lever arm and finger member limiting pivotal movement of the latter relative to the lever arm in each of opposite directions, and power actuator means connected to said frame and finger member to effect swinging movement of each of said lever arm and finger member about their respective pivots, swinging of the lever arm having lost motion caused by pivoting of the finger relative to the lever arm and limited by said stop means.

7. A grapple as defined in claim 6 wherein said first arm is pivotally mounted on said frame.

8. A grapple as defined in claim 7 wherein said first arm is a duplication of said second arm including a power actuator for controllably moving the same.

9. A device as defined in claim 6 wherein said means restraining movement of said lever member comprises a spring.

10. A device as defined in claim 9 wherein said spring and power actuator are interrelated such that pivotal movement of the finger relative to the lever member in a direction tending to bring such members into alignment end-to-end is effected before pivotal movement of the lever arm relative to the frame commences in a direction against the tension of the spring.

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11. A grapple as defined in claim 7 wherein said first arm is a duplication of said second arm including a power actuator for controllably moving the same and wherein said means restraining movement of said lever member comprises a spring; said stop means and spring means being interrelated such that the finger is pivoted relative to the lever arm before pivotal movement of the lever arm relative to the frame against the tension of the spring means.

12. A device for harvesting trees and collecting the trees as they are harvested, comprising in combination:

- (a) a frame;
- (b) a grapple mounted on the frame and arranged for grasping the trunk of a standing tree;
- (c) a tree severing device mounted on said frame and arranged for severing the trunk of a standing tree grasped by the grapple at a position therebelow; and
- (d) at least one articulated arm swingably mounted on said frame for movement from one position to another where in a first position the trunk of a tree can be placed in the grapple and in a second position it presses against the tree retaining the same in the jaw of the grapple while the latter is opened to receive a further tree, said articulated arm comprising:
 - (i) a primary member pivotally attached adjacent one end thereof to the frame and having a finger member pivotally attached thereto adjacent an opposite end thereof;
 - (ii) interengageable stop means on said primary member and finger for restricting pivotal movement of the latter relative to said primary member;
 - (iii) a power actuator operatively connected to said frame and finger member for pivoting the finger

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relative to the primary member generally in directions toward and away from said frame and for pivoting said primary member relative to said frame; and

(iv) means operatively associated with said primary member restraining pivotal movement of the same.

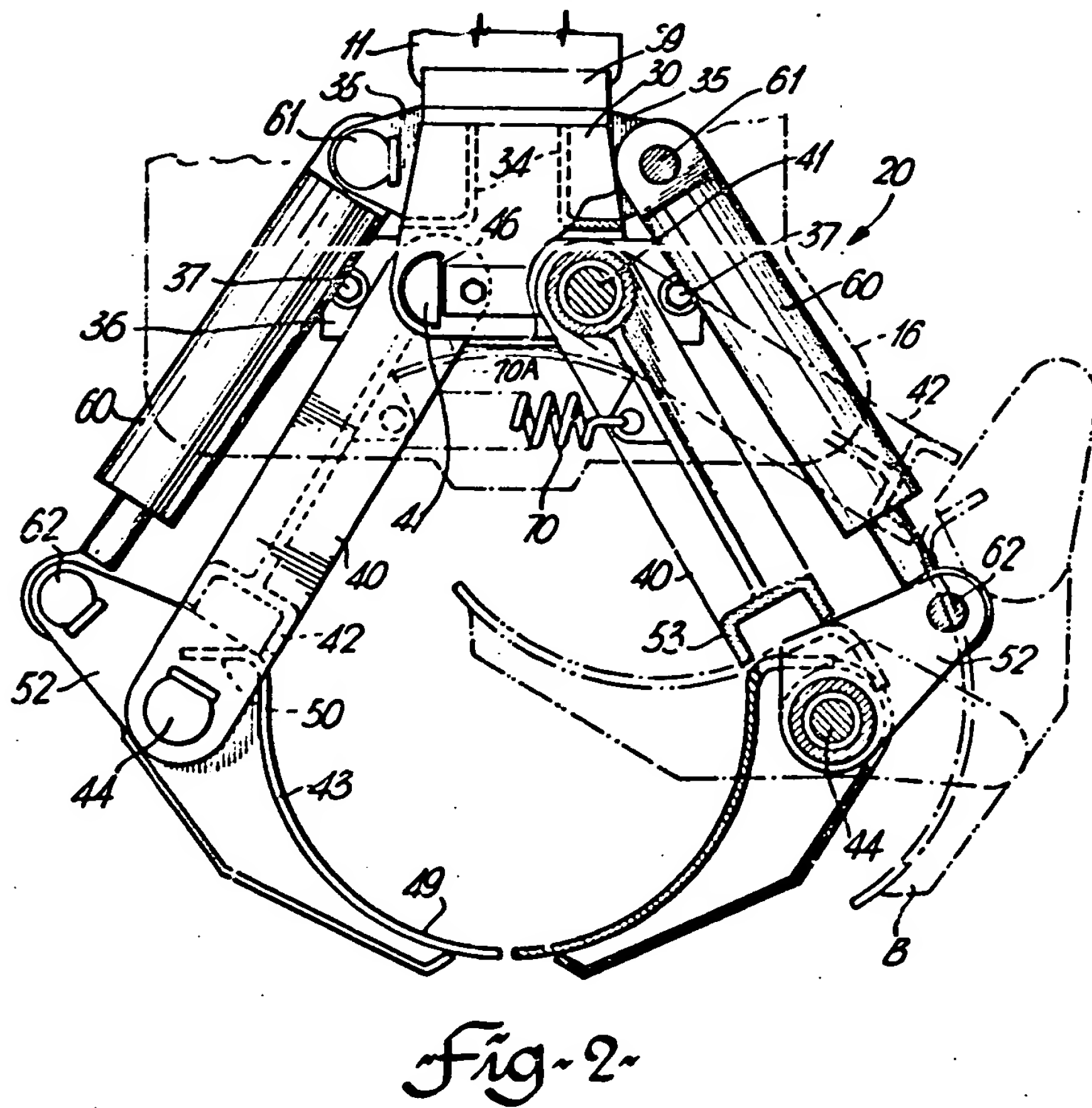
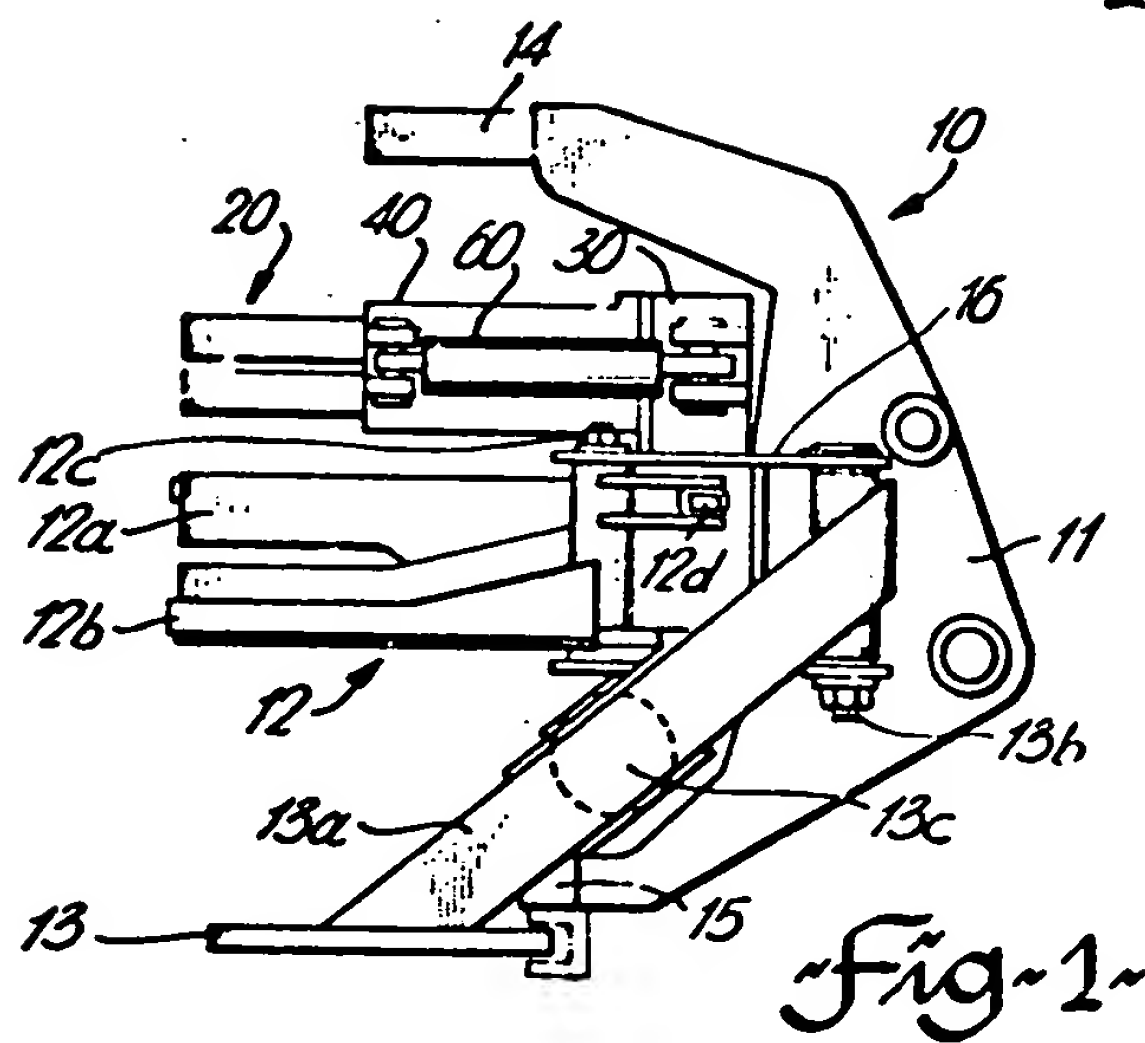
13. A device as defined in claim 12 wherein there are two articulated arms swingably mounted on the frame for grasping a tree or group of trees grasped by the grapple.

14. A device as defined in claims 3, 8 or 13 including stop means on said frame engageable with said articulated arms to limit pivotal movement of the same relative to said frame in each of a jaw open and closed position.

15. A device as defined in claim 12 wherein said means restraining pivotal movement of the primary members comprises a spring.

16. A device as defined in claim 13 wherein said means restraining pivotal movement of said primary members comprises spring means resiliently urging the free ends of such members in a direction toward one another.





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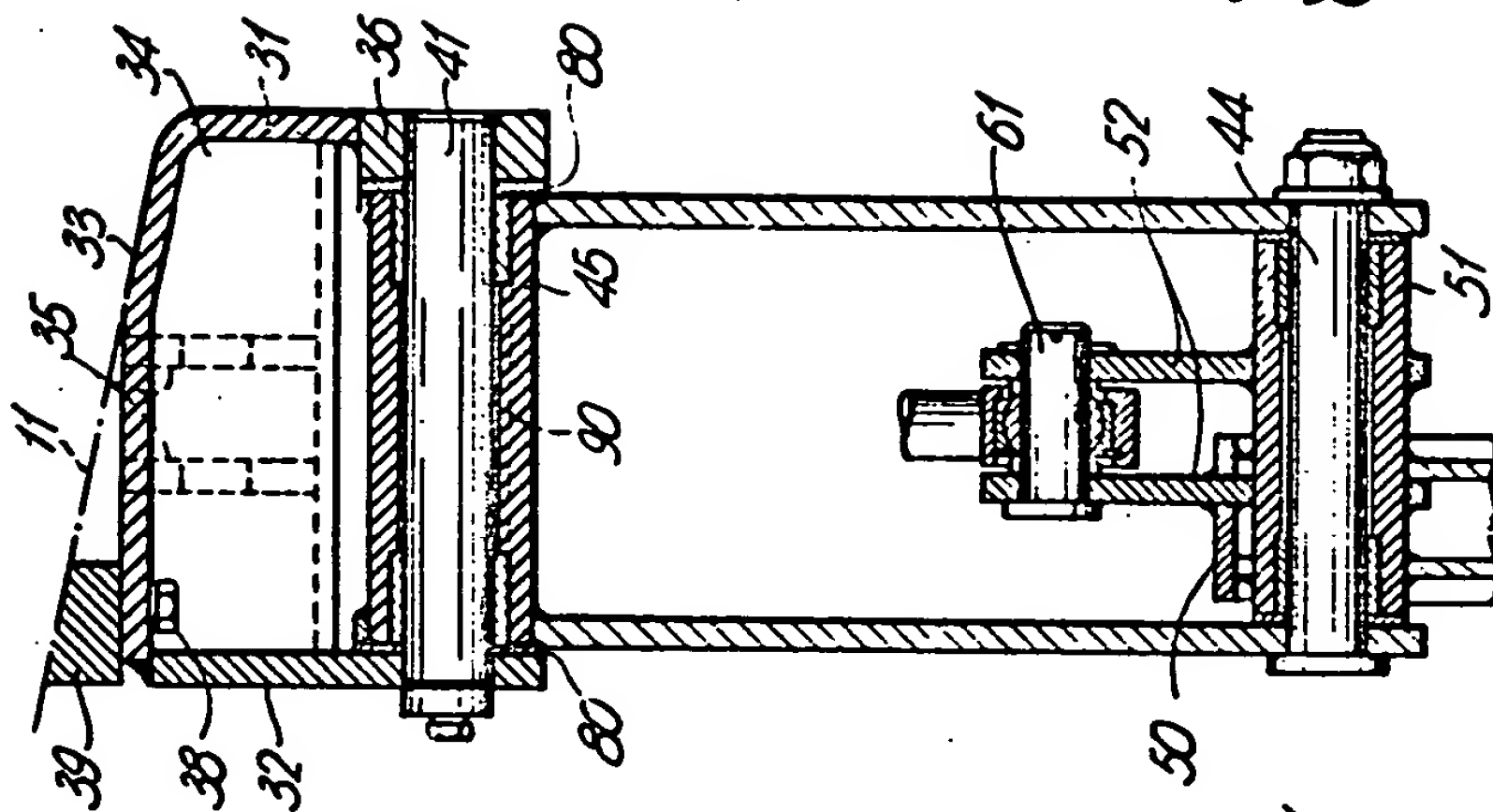


Fig. 4

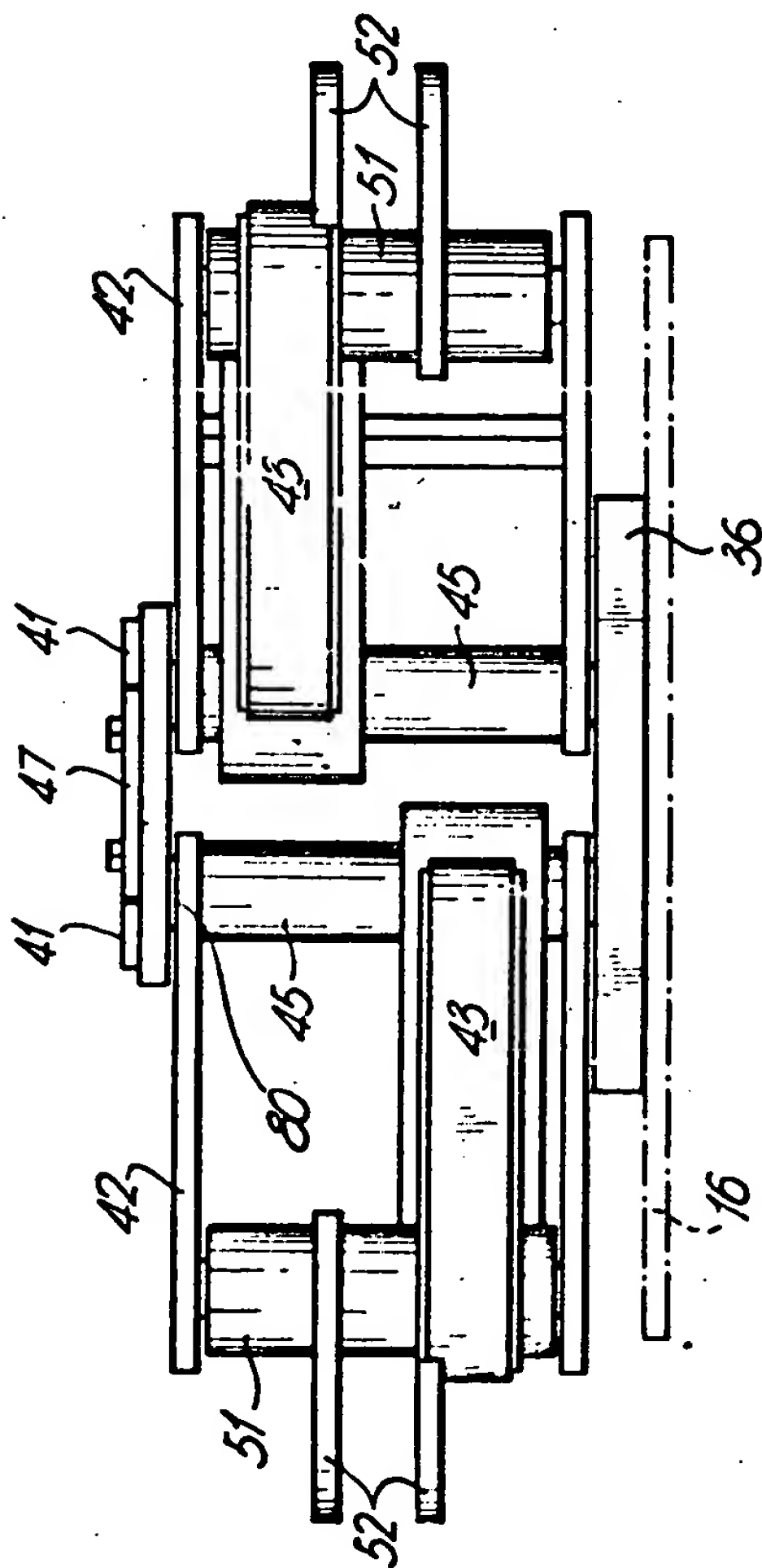


Fig. 3